ANNALS

OF THE

Association of American Geographers

VOLUME XIV, 1925

H.D.
1925

ALMON ERNEST PARKINS, *Editor*

PUBLISHED BY THE ASSOCIATION

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Annals of the Association of American Geographers

Subscription $3.00 per volume unbound; $3.50 in bound form.

Communications should be addressed to
ASSOCIATION OF AMERICAN GEOGRAPHERS,
George Peabody College for Teachers,
Nashville, Tennessee.

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ANNALS
OF THE
Association of American Geographers

VOLUME XIV MARCH, 1924 No. 1

GEOGRAPHY AND NATURAL SELECTION

A PRELIMINARY STUDY OF THE ORIGIN AND DEVELOPMENT OF RACIAL CHARACTER*

ELLSWORTH HUNTINGTON

INTRODUCTION.—Geography is primarily the science which describes and maps the phenomena of the earth's surface for the purpose of discovering how the distribution of one set of phenomena is related to that of others. The foundations of the science are the distribution of physical features like oceans, land forms, soils, minerals, and climate. Upon these to a large degree depends the distribution of plants and animals; then comes that of human occupations and modes of life; and at the top the distribution of human character and achievements. The pinnacle of geography is reached when we are able to explain why certain types of human character, certain manifestations of genius, and hence certain lines of progress and stages of civilization are localized in various parts of the world. Why, for example, was a marvelous outburst of genius concentrated in the little province of Attica? Why are the people of South China the most progressive of those who have long lived within the tropics, while the northern Chinese, on the contrary, are among the most backward of the people in latitudes 35° to 40°? Why did so sudden, so brilliant, and so brief an outburst of genius occur in Cambodia in the ninth century? And why does California hold so strong a position of leadership in the United States? Are these and other peculiarities in the distribution of human progress due to physical environment, to racial character, to historical accidents or to other causes not easily defined?

In *Civilization and Climate* and elsewhere I have shown that climate seems to have a profound influence upon human health and energy, and thus upon the ability of a people to make progress. Take, for example, four maps of Europe showing (1) the effect of climate upon energy, (2) the average death rate, (3) the number of eminent

* Presidential Address before the Association of American Geographers, Cincinnati, Ohio, Dec. 28, 1923. This address is a resumé of parts of a book entitled *The Character of Races* which will be published by Chas. Scribner's Sons in the autumn of 1924.

leaders since 1600 A. D. in proportion to the population, and (4) the degree of progress in recent generations. All four display essentially the same features. So close a resemblance is possible only if the climate is responsible for the general distribution of the other phenomena. Nevertheless, there are many phases of the distribution of human character which are not directly explained by climate. Neither are they explained by natural resources, location, or other physical conditions, nor by any historical principle that has yet been broadly recognized.

The puzzling way in which the distribution of human character and achievements departs from what one would expect on the basis of ordinary geographical reasoning has engaged my attention ever since the publication of *Civilization and Climate*. It was the main reason for a recent journey to Japan, China, Java, and Australia. As a result I have been led to conclude that the key to many of the most puzzling features in the distribution of human character is found in natural selection. Such selection is obviously taking place today; we have innumerable accounts of its unrecognized action in the past; and the way in which it seems to solve many hitherto unsolved problems is remarkable. Through its agency the character of a people appears sometimes to change so rapidly that racial character seems to be plastic rather than fixed as is so often supposed. Yet curiously enough natural selection has been almost neglected by geographers, historians, and other students of human activities. Much which seems to be largely due to such selection has been attributed to the direct effect of a new environment and its abundant resources, or else to the unexplained rise not only of individuals, but of groups of individuals displaying an uncommon degree of genius. As soon as the selective principle is recognized, however, its effects appear to be so clear that it will probably soon take its place as one of the important principles in geography, history, anthropology, and sociology.

Natural Selection in Australia.—Let us now consider briefly a series of examples. To begin with Australia, three qualities of the people of that continent stand out with especial clearness: the Australians are remarkably homogeneous, extremely prosperous, and enjoy phenomenally good health. By homogeneous I mean not only that the Australians are almost wholly British in origin, but that there is very little difference between one class and another, even less than in America. Only in our newest western states does the laboring man, the farmer, or the factory hand assume and maintain so nearly an equality with the professional man and the leader of business. The Australian chauffeur offers you a cigar, while the janitor asks you to shorten your lecture so that he may catch the 9.30 train, and then lingers till 9.40 to discuss some of the points you have raised.

In material affairs there is the same equality; Australia has few men of extreme wealth and few of extreme poverty, but it has many who are well-to-do and still more who are comfortably prosperous. A street car conductor may tell you that his wife was formerly a school teacher and that they are saving money for a trip around the world so that the "kid" may be well educated. He begins the conversation by noticing your badge of the Pan Pacific Science Congress and asking if you are one of the "merry-makers." Such a spirit of equality and prosperity is, of course, more or less characteristic of all new countries, but is it due directly to the newness or to some other factor which may last after the newness is gone?

Death rate in Australia vs. Other Areas.—As to the healthfulness of Australia there can be no question. In order to avoid complications let us take the normal period before the Great War. The crude death rate in Australia during that period (10.8 from 1907 to 1914) was lower than in any other country except New Zealand (9.4) and certain restricted areas in other countries such as the state of Washington (9.4 from 1908 to 1913). In Queensland, which lies partly within the tropics, the rate (10.3) was as low as in any part of Australia. The only states with equally good records were South Australia and New South Wales. The healthfulness of Australia is commonly assigned to three causes: first, the climate; second, the general prosperity and good food; and third, the excellent sanitary and medical systems and the many governmental agencies for the promotion of health. I recognize the importance of all these factors, but doubt whether they are really the chief causes of good health. One reason is that although the climate of a small area in the extreme south of Australia may be nearly as good as that of England and Denmark, for example, where the crude death rates from 1906 to 1915, omitting the deaths of soldiers, were 14.1 and 13.2, respectively, the Australian summers elsewhere are so long, so hot, and on the coast where most of the people live so damp that the climate is not so healthful and invigorating as that of the countries around the North Sea. Again, it is highly doubtful whether either food, medical practice, or sanitation are much better in Australia than in the North Sea countries or the northeastern United States. By far the most important reason for doubt, however, is that the low death rate of Queensland occurs not only where the semi-tropical climate is obviously enervating and is so recognized by most of the people, but where doctors are less numerous than in southern Australia, where even Brisbane, the largest city, had no sewage system as late as 1923, and where the food is poorer than in the South because of less fruit and vegetables, and more canned goods. Moreover, West Australia, with a crude death rate of 10.4, is much like Queensland in all these respects except that extreme dryness and heat replace tropical moisture. Thus the death rates

are lowest in the very places where all the factors yet mentioned would lead one to expect them to be highest.

These considerations led me at first to question the accuracy of the Australian mortality statistics. Careful inquiry, however, seems to prove that the mortality records are well kept. The fact that there are many young people in new regions like Queensland and West Australia has some effect in lowering the death rate, but even when this is eliminated by reducing the data to what is known as a "standard population" the rates become for Australia 12.1, Queensland 12.1 and West Australia 13.2, as against New Zealand 10.5, Denmark 12.4, England 15.2, and the registration area of the United States 16.3. This does not appreciably alter the fact that the Australian death rate is uncommonly low, while that of Queensland is remarkably low when the climate is taken into account. It therefore still seems necessary to find some explanation aside from climate, prosperity, food, legislation, or the sanitary and medical systems.

Selection in the Home Land.—The explanation of the homogeneous and prosperous condition of Australia, as well as of the low death rate, seems to be found in natural selection. The Australians are physiologically different from the average people of the British Isles. Suppose that a thousand men think of migrating from Great Britain. A three-fold selection at once takes place. First, those who have organic diseases are likely to hesitate. The man who knows his heart to be weak, his liver torpid, or his kidneys diseased usually wants to stay where he thinks that he will be always near good medical care. A few, to be sure, migrate for the sake of health, especially if they have lung trouble, but they are exceptional and fall under a different category shortly to be mentioned. The health of the men themselves, however, generally counts less than that of their families. The man who has an ailing mother, father, or sister, or most of all, a wife or child who is not strong, is likely to be deterred from migrating. Or if he migrates, he chooses the United States or Canada because those countries are nearer, older, and better established than Australia. Thus as a general rule only those who are physically strong and whose families, especially the wives, are also physically strong make the long journey to Australia. Of course such people are healthy and have healthy children so that the death rate is low.

Finances and the qualities which enable people to lay by something against a rainy day are another strong selective factor. After the prospective migrants have unconsciously sorted themselves out on the basis of health, they are again selected on the basis of their available capital. Those who cannot raise enough money to pay their passage perforce stay at home. Many other cases are like this: A family has

a hundred pounds. If they go to Australia, all the money will be gone before they get there. If they go to the United States or Canada, there will be sixty pounds left to help in making a new start. Thus so long as migrants are not assisted, those who go as far as Australia are selected because they have the ability to save more money than is required of those who stay at home or go to nearer countries. As a rule, however, the well-to-do and those who have already acquired an established position do not go to Australia. Those who go from such families are usually only young men whose characters are still pliable. Thus there is selection at both ends of the social scale so that the extreme types rarely go to Australia. That is one great reason for the uniformity among the Australians both socially and financially. Indirectly, to be sure, the new country is the cause of the uniformity, but if all classes in the old country were brought to the new in the same proportion that they exist in the old, it is very doubtful whether there would be anything like the uniformity which now exists. The selective process is needed to produce uniformity.

A third type of selection is based on moral character and temperament. We have already noted that among those who have organic diseases only the ones with unusual courage go so far as Australia. Everyone who migrates so far needs an unusual degree of courage and initiative. This is especially true of women. It is far easier to stay at home or even to migrate to Canada or the United States than to go to that distant continent in the midst of the Southern Ocean. Only the man or woman who is optimistic and brave dares attempt it. In the early days this was far more true than now. Thus in those earlier days the great mass of the immigrants to Australia were people of unusually strong physique, of at least moderate although not necessarily extreme ability in the work of making a living, and of an unusually optimistic, courageous, and motor-minded type, people to whom there was zest in the idea of doing something new. A few there were who came out as convicts, but the importance of these has been greatly exaggerated. Many of them were sent for political reasons or for debts, and were not really bad people. Even those who were genuinely criminals have fortunately left few descendants, for they were almost wholly men, and the great majority never found wives in the new land so that their descendants are negligible. Thus Australia as a whole has been peopled by individuals who have stood the test of a three-fold selection for health, industry, and initiative. In the later days it has been easier to come, and now the government is actually assisting immigrants so that the average level of the newcomers is rapidly falling, but that has not yet had much visible effect, although presumably it will ere long.

Selection Within Australia.—The relation of Queensland to the rest of Australia is almost like that of Australia itself to Great Britain. Most of the settlers in Queensland come first to the great cities in southern Australia. There they hear of the difficulties, the poor climate, and the loneliness of the North, as well as of its great possibilities. So once more among the selected Australians there takes place another selection in which health, financial status, and individual temperament play the parts already described. No wonder, then, that tropical Australia is inhabited by an exceedingly healthy, energetic, prosperous, and optimistic set of people. Almost nowhere else can one find their equal in these respects.

Queensland and Denmark Compared.—A statistical analysis of the death rate furnishes an interesting verification and amplification of the preceding conclusion. In order to determine what is really happening in Queensland I have compared the death rate there at different ages and for the two sexes with the corresponding rates in Denmark. That country was selected for comparison because it is peculiarly normal. It has a good climate, its people are mainly agricultural and live on farms or in small towns and villages; and its one great city, Copenhagen, has only a small percentage of the kind of factories which are especially inimical to health. Moreover, Denmark has had relatively little emigration or immigration, so that there has been no special selection among its people. The general result of this comparison is that among infants of both sexes is only two thirds as great as in Denmark, while among children one to ten years of age the rate in the two countries is about the same, being very low in both cases. At the age of puberty, however, a marked change appears: the death rate among Queensland girls begins to fall while among boys it rises. At the age of fifteen to twenty-five the rate among the young women of Queensland is only 80 per cent as great as among young women of the same age in Denmark. Among young men of that age the Queensland rate rises to 10.6 and among men of thirty-five or forty to 13.4 per cent of the Danish rate, even though the Queensland life is not especially hazardous. Even if we allow for accidents, the Queensland deathrate for men at the age of forty is as much above the Danish rate as the Queensland rate for women at the age of twenty is below the corresponding Danish figure. Such a difference is astonishing, especially in view of the fact that life in Queensland is especially hard for young women. Many live far from physicians and hospitals. It is almost impossible to get nurses and servants even when the children are born. Worse than this is the fact that the houses are mostly one-story bungalows, a large share of which have low roofs with no ceilings and often with roofs of sheet iron. The thermometer rises to ninety or a hun-

dred degrees Fahrenheit day after day for months, and the almost vertical sun together with the kitchen fire raises the temperature to 110° or even 120° day after day in the places where the women are at work.

Death Rate of Young Men and Young Women in Queensland.—How then, is it possible that the death rate among young women should be well-nigh the lowest in the world, twenty per cent lower than in Denmark during the years 1906 to 1915. The answer seems to be natural selection. If a woman finds that the climate and the hard life in the hot kitchens does not agree with her, the family moves to a cooler region as soon as possible. Sometimes the wife goes first and the husband follows. If a young boy and a young girl in a family are not well, the boy is sent to a sheep station, perhaps, to build up his health, but the girl is sent South to her grandparents, and if it is still impossible for her to be well in the North the family at length takes the first opportunity to move South where it is cool. The general manager of the Northern Railways of Australia told me that he is besieged by requests for transfers to the South, and the reason given in the majority of cases is the wife's health. This, he believes, is the true reason; the same condition prevails in many other lines of business. Thus it appears that natural selection has reduced the death rate in Queensland to extraordinarily low proportions, especially among the young women. It has given Queensland a picked population, in which the women are the most highly picked portion. No wonder the children are healthy when they have such mothers. Nor is it any wonder that in northern Queensland one finds a degree of optimism and initiative which can scarcely be paralleled. Natural selection has here created almost a new race. If no new settlers should come for hundreds of years and if the weak and inefficient and those lacking initiative and optimism could continue to be weeded out, it is hard to tell how far the people of North Queensland might diverge from their relatives in Great Britain.

NATURAL SELECTION IN ICELAND.—Now let us turn to Iceland where a strong selection of migrants was followed by a long period without admixture of other types. According to Lord Bryce no primitive literature except that of Greece rivals that of Iceland. Among people born since 1600 A. D. the nine men from Iceland give that island a larger representation in the *Encyclopedia Brittanica* than has any other country in proportion to the population. As to literacy Iceland rivals the most favored parts of the United States and Europe even though many of its children live in such isolation that they cannot attend school. Their mothers teach them at home. In respect for law, in protection of individual rights, in the readiness and skill with which they have adopted modern ideas, and in true democracy of gov-

ernment, it is hard to find any country which surpasses Iceland. So, too, in foreign trade and in the absence of abject poverty Iceland stands uncommonly high. This is true in spite of the fact that the natural resources of the island are of the scantiest, periods of famine have been frequent, and most of the people live very simply. Aside from grass there is practically no crop of any kind, trees are limited to a few areas of saplings; and sheep, cattle and fish are the only important resources. Yet Iceland, in proportion to her population is an influential nation. If that island had a hundred million instead of a hundred thousand people, and if they had contributed to human progress as much proportionately as have the present Icelanders, our encyclopedias would overflow with Icelandic names.

The Settling of Iceland.—The reason for Iceland's peculiarly high position in spite of the poor environment seems to be natural selection. Up to the ninth century of our era Iceland was uninhabited except by a few Irish monks. In that century a certain Harold made himself king of Norway, and for the first time imposed regular taxes on all the inhabitants. So long as only the common people were taxed the upper classes made little complaint, but when Harold began to tax their own land and thereby take away that absolute sovereignty which was their dearest right, they rose in rebellion. But Harold was too strong for them. Thereupon a great migration took place. Some being more warlike, harried the coasts to the south and established themselves as the Normans. Others, more peaceably inclined, but equally determined, crossed the stormy sea to Iceland. They were no ordinary people, but the best blood of the land, the people who by right of superior intelligence, skill, and energy had gained control. They took with them some dependents, but apparently these were generally the ones of exceptional ability, vigor, and love of adventure. To take those who feared to go would have been sheer madness. Thus during the sixty years from 870 to 930 A. D. Iceland was settled by some fifty thousand people, the cream of the Norse; and the Norse as a whole were then as now among the most competent people of Europe. Thus a political event, which may also have been accompanied by bad crops, led to a stringent process of natural selection. Because Iceland was the nearest uninhabited land which they could reach by sea, these strong, vigorous people established themselves upon that cold, damp, and unproductive island.

Effects of Conditions in Iceland.—Since then for a thousand years there has been practically no immigration into Iceland. The broad, stormy seas, the location of Iceland far from any frequented line of travel, and the innate poverty of the island explain why it was not sought by later immigrants of weaker caliber who would have diluted

the old stock. The same conditions of storminess and isolation, together with the freedom which they made possible, reduced to small limits the outward migration whereby the more virile elements might have been lost. Thus during a thousand years the racial inheritance of Iceland has remained almost unchanged. The old virility and ability still seem to remain. Because of the hard life the weak and those who lacked the keenness and caution needed by fishermen in dangerous waters have been killed off. The death rate even now among the young men when they first go out in the fishing boats is enormous. Thus in Iceland we still find a degree of culture and progress which seem out of harmony with the climate, the resources, the isolation, and practically all the important factors except the inheritance. The persistence of a good inheritance in this remote spot suggests that there is no inherent reason why races should decay.

Natural Selection in the Colonizing of America.—New England furnishes another example of a peculiar distribution of human ability. Both in its first American home and in its newer homes farther west the old New England stock has given rise to eminent men in numbers far out of proportion to its numerical position among the people of the United States. In order to explain this we must go back to England in the sixteenth century. At that time there flared up for some reason a great wave of intellectual activity, which manifested itself most strongly in Shakespeare, Bacon, and other men of genius. In many cases this wave took the form of a deep interest in religion. Among the millions of English and Scotch a few hundred thousand were unusually thoughtful, religious, and determined. They had such strength of mind that they came out from their fellows and suffered obloquy rather than sin against their consciences. Thus a fraction of the English people were sifted out by a first process of selection. Now among the Puritans there were some who had the Puritan type of mind more strongly than the others and who also had a brave and adventurous disposition and a spirit that was not willing to bend the neck to any yoke but that of their own making. They migrated to America, travelling over stormy seas to a land of cold winters, vast wildernesses, and ferocious savages. That was the second selection.

With this second selection went a third. The physically weak could go to early America far less than their descendants could go to Australia. Many a Puritan doubtless stayed at home because he had a wife or child who could not stand the strain of the voyage, the wilderness, and the bleak winters. Moreover, among those who made the voyage many soon perished in the harsh new country and not a few went back to the old home discouraged. It was a time which not only tried men's

souls but remorselessly sifted out the weak in body and spirit. Thus the Puritans in early New England were by inheritance different from the average people of Old England. That is the important point. It was this inheritance, I believe, more than any other circumstance, which made New England the birthplace of the modern form of democracy, of universal education, and of many other new ideas. It was this same inheritance which today causes people of old New England descent to occupy positions of influence far out of proportion to their mere numbers.

In other parts of the United States those early years saw a similar selection. The Huguenots in the South, the Quakers in Pennsylvania, and other groups who though not animated by religion had a high spirit of adventure and initiative were selected most rigidly. It was the descendants of such men who framed the American constitution, which is probably the greatest document of its kind, and the model for half the governments in the world.

California as an Example.—Pass on now to another example. Why has California surged to the front so rapidly in the affairs of America? Is it her climate, her harbors, her gold, her crops? These are certainly important, but her peculiar people are probably at least equally important. The Forty-Niners who first came to California were a peculiar people. In those days the man who would go to that distant territory needed considerable money and much grit, or else a double portion of grit. He likewise needed physical vigor and a strong spirit of adventure and initiative. In other words, the majority of the Forty-Niners were above the average in the qualities that cause a nation to make progress. They were a selected people, chosen from a people who had already been through a rigid process of selection. An unusually large proportion of them, by the way, were college graduates.

After the gold rush was over many of the Forty-Niners drifted away, but a large number stayed to till the fertile wheat lands or engage in commerce and industry. Then they began to bring their wives and sweethearts from the East. Here, too, the same great selection went on. California was still a hard place to reach, far harder than the states which were already connected with the Atlantic coast by rail. Only the braver and more adventurous women, and those with strong physiques, went out to that far land across the Sierras. The others made their husbands or lovers come back or stay at home. Thus early California was settled by men and women of unusual vigor and initiative, strong in body and mind.

After the railroad was built the selection was less strenuous, and now when one can pile everything on a Ford car and rattle across the continent, it is reduced to still lower limits. The easier the migra-

tion, the lower the average quality of the migrants. That is the rule. People who are carried by a government or have all their plans made for them by a steamship agent do not need those vigorous qualities which are absolutely essential to the pioneers. In California, however, another element, namely the climate, still keeps the selection of newcomers at a rather high level. People of means and culture, people who have achieved success because of an unusually good inheritance of mind and body, still go to California because it is a peculiarly pleasant place in which to live. Thus the Los Angeles region has obtained a selected type of immigration different from the Forty-Niner type, but no less different from the average of the United States as a whole. Hence it is not surprising that California has universities which rank with the most influential in the country, and great scientific institutions which find no parallel elsewhere beyond the Mississippi and scarcely until the Atlantic seaboard is reached. Nor is it surprising that California is the home of many new experiments in social and political relations. Here is the sequence: the lure of gold, of wheat, of climate; the choice of special types of migrants who have great vigor and initiative or who have achieved more than the average success in life; a population with a different inheritance from that of the other parts of the country; and hence the building of a new type of culture which borrows freely from the old, but has an individuality of its own.

The Progress of Hawaii as a Result of Selection.—The list of places where this process of selection has taken place is so long that we seem to be face to face with one of the most important principles in geography and history. Selection has been vigorously at work in practically all parts of America during recent generations; it has played and is still playing a part in Europe, Asia, and every other continent, where men migrate, or where unusual events cause changes in the death rate. It is active in the islands of the sea. Does Hawaii, for example, occupy its present position of prosperity and progress because of its climate, its sugar estates, its position as a center of trade, or its people? Here, as in so many other cases, various causes combine to produce the observed results. As to climate Hawaii is certainly much better off than most regions in the same low latitude. It is cooled by the trade winds and is unusually free from tropical diseases, but the climate is not particularly stimulating, especially from the standpoint of mental activity. As for resources, there are probably several million square miles within the tropics which might be as productive as Hawaii if developed with equal skill. The fact that a place is a center of trade

routes is not an assurance that it will develop a high type of civilization. Look at Gibraltar, Constantinople, Suez, Aden, Colombo, Singapore, and Hongkong. Each of these is probably a more important center of trade routes than Honolulu. Yet few would say that in progressiveness, culture, and general desirability as places of residence the others excel or even equal Honolulu. Much of the secret of Hawaii's progress seems to lie in the fact that her early white settlers were so largely missionaries. Hawaii is one of the few places where missionaries converted a people and then settled permanently and went into business. Their presence did much to make Hawaii attractive to other business people of an unusually high type, and the pleasant climate helped them. Today a remarkable percentage of Hawaiian leaders are the descendants of missionaries, and their presence has gone far to maintain high standards.

Natural Selection in Indo-China Among the Khmers.—In some cases deterioration has followed the selection of high types of human character. In Indo-China not far from Saigon the province of Cambodia contains the famous ruins of Angkor Wat and Angkor Tom. Three facts about these ruins are peculiar. First, they are of great beauty and stateliness, being of vast size and adorned with innumerable finely carved statues and reliefs. Competent judges rank them among the world's masterpieces. Second, the ruins display many peculiar features not found previously in Indo-China nor in India whence the basic features were derived. Apparently the builders were an original people who added to the old Indian models many new ideas of their own. Third, the ruins are a mere flash, as it were. Not only do they appear as something new without a long series of predecessors denoting a gradual evolution, but they had practically no successors. The makers constructed a few great buildings within a few generations. Then something happened to them; they did not go on with new works of art, nor do we even find signs of slow degeneration.

The builders of Angkor Wat and its neighbors were the Khmers, related to the Brahmans of India. They first appeared in northern India, but were either pushed out by famine, invasion, war, drought, or other cause, or else moved out because they hoped to better their lot. For generation after generation they pushed their way southeastward; bag and baggage, men, women and children, they pursued their weary journey. Slowly, painfully, and with much fighting they presumably worked their way through the plains of northern India, over the great mountains of Burma, down the great river valleys, and through the thick, deadly forests. Again and again they may have tried to settle,

but were driven on by their enemies. We have no details of their sufferings but we know that under such circumstances there is always a tremendous death rate. The men die in battle or from over-exertion; the women and children from weariness, hunger, exposure, and the distress and disease engendered by painful marches, scanty food, poor shelter, and homelessness. Only the strong in body and spirit survive.

When the Khmers at length reached Cambodia and found a place where they could settle, we may be sure that they were a selected remnant endowed with an unusual inheritance of physical and mental vigor. Their social inheritance may have been small, but it was easy to learn the arts and crafts of India, even if they had been almost wholly forgotten. The transfer of culture from one people to another is a simple matter compared with the development of a high inheritance. Thus when the rare abilities and energies of the Khmers were no longer fully occupied with the work of migration and defense, they turned to other channels. Like almost every people under similar circumstances, the Khmers devoted part of their energy to permanent works of architecture and sculpture. Their blossoming at Angkor Wat was like that of the Californians in their great university.

The Decline of Civilization Among Khmers.—Just why the Khmers came to the end of their upward progress we do not know. Here again we can only reason from similar cases elsewhere. One probable cause of decline was the debilitating climate, the malarial fevers, and the other diseases which prevail in Cambodia, for unwittingly the Khmers had settled in a highly unfavorable environment. Another cause was probably intermarriage with the natives whom they had subdued. The natives probably furnished an abundant supply of manual labor for the great architectural works, but intermarriage also probably took place on a large scale, for that is the almost universal custom in such cases. If the conquered people were slow and incompetent, as seems probable, it would take but a few generations for the high inheritance of the conquerors to become weakened and debased. Such a condition, together with the enervating effect of luxury and a tropical climate is quite enough to explain why the Khmers soon ceased to be a great people and were ousted from their position. In Java an almost identical development took place, except that there the Hindus who built the wonderful ruins were merchants rather than warriors. But they were a chosen few, they conquered the inefficient natives and made them work; they built great and beautiful temples; they degenerated through such causes as climate, disease, luxury, and intermarriage; and the place of their greatness knew them no more. The contrast between

the rapid decay among these tropical peoples and the persistence of high ability for a thousand years in Iceland may be due in part to climate, but it seems to me that the preservation of the racial inheritance is perhaps an equally important factor.

NATURAL SELECTION IN CHINA.—As a final illustration among the many that present themselves, let us take China. One of the strangest things about China is that the most conservative section is found well toward the north in the provinces of Shantung, Chihli, Shansi, Shensi, and Kansu. The Chinese frequently comment on this fact. It shows itself in the way in which the people of South China travel all over the world, while those of North China rarely go abroad. It appears in the seclusion of women in the North and the persistence of the habits of foot-binding and the wearing of queues. Yet the northern provinces are in many respects highly favored: at least in the coastal portions they have abundant rain and can raise vast crops; they are largely composed of wonderfully fertile and level plains; they have abundant coal; they might have abundant forests if they displayed even moderate wisdom in conservation; and they have a healthful climate which is almost free from the intense cold of regions like Manchuria and from the prolonged moist heat which is so trying farther south. Thus on the basis of ordinary geographical reasoning one would expect this portion of China to be the most progressive, but as a matter of fact it is greatly excelled not only by South China, especially the coastal region, but by Manchuria.

The relatively progressive character of South China and Manchuria is often ascribed to long contact with Europeans. But by the same reasoning Ceylon and Java ought to be well ahead of South China, which is not the case; North China ought to be ahead of Japan, which is still more untrue; and Manchuria ought to bring up the rear which is very far from the case. Racial mixture has also been suggested as the cause of progress in the South, but this is disproved by the fact that the most progressive people both in the South and in Manchuria are pure Chinese.

The most progressive people of South China appear to be the Hakkas, a peculiar people living among the mountains one or two hundred miles north of Canton. The coast people fear them and hence speak slightingly of them, but missionaries who have lived among them and also among other Chinese say that they are the cream of the Chinese. In their central district 80 per cent of the men are reported as knowing how to read, the largest percentage in China. They are the only Chinese who have never bound the feet of their women, and

women among them receive an unusual degree of respect. When the Hakkas come down to the coast cities the coolies are so energetic that they take the work away from their lowland rivals, while the merchants rise to positions of great influence. The same is true in Singapore, Hawaii, and elsewhere. It may be pure accident, but it was interesting to me that the first and only educated Chinese woman with whom I ever dined was a Hakka.

The Hakkas are a Mandarin-speaking group of Chinese who have pushed their way south from the plains of the Yangtse Valley or farther north into a rough maze of mountains. On the west they expelled the primitive Miaotse and on the east the earlier Chinese who speak the so-called tonal forms of the Chinese tongue and now live along the coast. The first Hakkas migrated in the fourth century, others in the ninth, and the last in the thirteenth and fourteenth. All of these were times of dire famine, and the last period saw the most terrible famines ever experienced in China. Even the Yangtse Valley and the favored provinces of Chekiang and Fukien along the coast were afflicted with droughts and floods. At the same time the Mongols poured in from the north, creating almost inconceivable confusion. According to the old Chinese accounts innumerable homeless, hungry people were wandering over the country seeking homes where there were no famines and no Mongols. The Hakkas apparently formed a section of these wanderers who had the initiative and vigor to push far southward. Like the Australians, the Puritans, and the Khmers, the Hakkas must have suffered a strenuous natural selection. Those who finally settled in southern China were presumably the strongest in body and mind. There is good reason to believe that the other Chinese of South China represent similar migrations in earlier times. Thus we conclude that the progressiveness of South China is an inherited trait due to strenuous natural selection.

This same process of natural selection through famine and migration is still taking place before our very eyes in North China. Because of chronic over-population and economic distress and because of occasional sharp famines as in 1921, hundreds of thousands of Chinese from Chihli and Shantung are moving northward into the relatively uninhabited regions of Manchuria. At the end of each winter tens of thousands of farmers from Shantung, for example, go north by rail or on foot. They work till autumn, and then wander home. But the more energetic and competent pick up a bit of land, and then another bit until they have enough to warrant the building of a shack for the family. Next winter a father is seen pushing a wheelbarrow while his boy tugs on a rope ahead. The grandmother and the household

goods are on the barrow; the mother walks behind with a pole over her shoulder from which hang two baskets, one at each end, containing the babies, while the other children straggle anywhere. A selected family of the most energetic people in Shantung has come to Manchuria.

The most energetic and progressive of the Chinese settlers often fail to remain where they first settle. Land rises in value; the farmer sells out at a profit, and moves north again, this time with a wagon and three horses. In the far north of Manchuria many farmers have moved two or three times. Thus the north, in spite of its tremendously long, cold winters, gets the best settlers and hence is most progressive. That is what seems to be happening all over the world. A migration causes natural selection; the more strenuous the migration, the greater the selection.

Examples of Adverse Selection and Its Results.—Sometimes selection is adverse. This is what is happening in Shantung and Chihli. For two thousand years the more energetic and progressive Chinese have been moving away, while the slower and less active ones have remained. It is as if from a flock of hens every one that shows any white should be carefully removed for generation after generation. The time would come when scarcely a trace of white could be found, and all the fowls would be brown or black. It is apparently an adverse selection like this which causes much of the maddening inertness and terrible beggary which are so common in North China. This same adverse selection has probably helped to make the villagers in certain parts of North China so dull that American relief workers in the last famine raised the question whether they were not actually deficient in mind, mere morons.

Here we must leave the problem of natural selection. Hundreds of other possibilities present themselves. How far, for example, are the troubles of Ireland due to a constant depletion of the stock by the migration of the more able leaders to England and later to America? How much did the selective action of prolonged migrations have to do with the greatness of Athens and the pristine virtues of the Romans and Gauls? How much has England suffered from migration in recent years, and how far has her system of aristocracy prevented the loss of leaders? Obviously there are almost innumerable cases where the principle of natural selection may have played a leading rôle in great historical events. It is time that this principle received much more than the cursory attention which has thus far been its lot.

THE SURVEY METHOD IN GEOGRAPHY AND ITS OBJECTIVES

CARL O. SAUER

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THE CENTRAL THEME OF GEOGRAPHY.—Even a casual observer of the geographic field must be impressed by the progressively changing orientation of the subject. A vigorous evolutionary condition is indicated by the rate of modification and the increasing definiteness of trend in geographic concepts. Similar developments appear to be taking place simultaneously in widely separated localities, the greatest activity being in countries of western Europe, where the fundamental notions of geography are being reexamined and redefined in various quarters.

The general tendency is to consider geography in its central theme as a social science, concerned with the areal differentiation of population and occupation. In this view areal relation of human groups becomes the identifying mark of geographic studies, as time relation does of history. In a broader sense, then, geography rests on the concept of distribution of life phenomena, even though the charting of some such phenomena may be reduced to absurdity. Yet it is true that if vegetation were evenly distributed in amount, similar in kind, and undifferentiated in habit over the entire earth, there would be no plant geography. Under parallel circumstances there would be no human geography, nor would there be any important reason for the study of physical geography. Distributional differences of life therefore represent the distinctive field of geography. The first task is to chart such significant distributions; the next is to explain them. This field of inquiry is not subject to challenge by any other science; its elaboration is resulting in the development of a distinctive geographic technique.

Objections to "Geographic Influences."—This position involves a conscious reaction from many of the older traditions of modern geography as fathered by Ratzel, which are derivatives from determinist philosophy. The argument from physical cause to human consequence, facile, alluring, and plausible, rather curiously has had more vogue among British and American geographers than has been the case on the continent.[1] The tendency of this school of environmentalism is to seek out the so-called geographic influences with the purpose of determining the potency of the physical environment. It is difficult to do scientifically sound work under this plan. At best it is likely only to throw a half-light on the human scene. The protagonist of a particular viewpoint ordinarily arrives at results that are inferior in value to the conclusions formed without predisposition in favor of a particular answer. Herein lies the superiority of historical research in its catholic sense to most historical geography, and to other particular interpretations of history, such as economic and racial histories and the familiar pageantry of the great personalities in history.

A well-founded objection to much geographic study is based on the fact that the geographer has taken the affirmative side in a debate on environment and has therefore failed to maintain the objective quality of the scientist. A better knowledge of the value of physical environment is one of the ultimate goals of geography, but is it more important to geography than genetic studies are to the biological sciences? Must not the geographer rely in a large part on the verdict of the physiologist as to the significance of heredity and of environment and is it a matter of particular concern to himself what relative values are attached to each? A science can hardly be committed in advance to a particular theory, but must rest rather on a distinctive field of inquiry that is independent of the affirmation or negation of theories. The bias of environmentalism has resulted for numerous workers in geography in premature generalizations which have been wrongly considered to represent the content of the subject. History has been undisturbed in the main by too sweeping generalizations, has been quite content to classify laboriously the records of the past, and is soberly cautious, even skeptical, regarding great trends of social forces. The example should be valuable to geography. Thus, it may be argued, geography is obligated to spend an arduous period of apprenticeship in organizing its method of approach to its field and in proving its capacity to develop that field without prior subscription to any set of theories of

[1] See Review by Mark Jefferson of Febvre; La terre et l'evolution humane, *Geog. Rev.*, Jan. 1923, p. 147.

social dynamics. Geography is partly the history of today, and as such may profit by the example of historical research.[2]

COMPARABLE SITUATION IN THE SOCIAL SCIENCES.—It is no detraction of the field of geography to insist that a very great amount of precise systematic and analytical work needs to be done before the time is ripe for the more brilliant synthesis of broad conclusions. As yet we have barely begun to state to ourselves the problems of the field. As a social science geography is joined to a group of subjects that are having a similar change of mind. Economics and sociology began with a philosophical basis and sought immediately to elaborate a set of "laws." These a priori principles are being discarded under a recently developed agnosticism that is substituting scientific inquiry for the dogmatism of their earlier creeds. They are relying now upon the historical method of tracing the growth of institutions, on statistical correlations and their interpretation, and are even introducing various survey methods. The parallel to geography, obviously, is close.

Results in the fields of social studies have not been large or final. The relations of social groups constitute problems of enormously greater complexity than are characteristic of the natural and physical sciences, where experimental methods moreover provide a large measure of control over conclusions. History and geography jointly have the task of laying much of the foundation for political economy, sociology, and political science. May it be too much to believe that as the period just past was the classical age of the natural sciences, so the great opportunity for research in the immediate future is in the study of human relations?

METHODS OF GEOGRAPHIC INQUIRY.—Geographic knowledge rests upon disciplined observation and is a body of inferences drawn from classified and properly correlated observations. By prior definitions the geographic facts are the areal expressions of man's activities. We are concerned here simply with the relevance of the observations and the manner in which they are made.

The geographic fact, in order to be significant, must be an expression of a normal group condition. That is, it may be an average drawn from numerous unit observations or it may be an individual type which

[2] Unstead, J. F., Geography and Historical Geography, in *Geog. Journ.*, vol. 59, (1922), p. 55ff. See also Gleason, H. A., Vegetational History of the Middle West, ANNALS ASS'N. AMER. GEOG., vol. 12, pp. 39ff. for a valuable exposition of the parallel field of plant ecology. The latter makes the somewhat broad statement that "the geography of man has long been recognized as merely the present condition of his history." (p. 41.)

is demonstrated to be representative, actually or potentially, of a significant group. For example, the predominance of corn growing on hill-side farms in the Cumberland Plateau region may be established by tabulation of the percentage of crop land in corn in a representative group of farms located on steep hill-sides. It may further be illustrated by the detailed description of a typical farm that represents average conditions. A farm that does not follow this practice in this region, but which has substituted therefor another crop system, is significant only if it represents a better system which farming in that area must adopt if it is to continue permanently. Brunhes and Vallaux have well stressed the fundamental importance of the statistical coefficient to geography and quote Borel as follows, "In the social sciences, in the broadest sense of the word, the statistical method imposes itself most often as the only possible one and gives sufficient results so that one need not regret that there is in many cases no other scientific method."[3]

The ideal method of such quantitative study is by systematic field work. To the future of geography the geographic survey may play as important a rôle as systematic areal work has done in the various fields of geology. Its purpose is to supply an adequate, systematized body of significant data out of which generalizations may shape themselves with increasing diversity as the source material grows in amount. Next in value is the mass of official statistical material, as embodied in the census and in many other statistical tables of state and national offices. The intelligent selection of these data for cartographic representation and the interpretation thereof however presuppose a considerable amount of direct observation in the field. Less trustworthy than either of these methods is geographic correlation based on literature which is not the result of geographic field work. Such library work is a common form of geographic writing, proceeding quickly to the inferential stage by the acceptance of facts which have not been scrutinized geographically at first hand. Because geography is an adolescent science we cannot, unfortunately, trace the roots of the present back into the past, except by collating diffuse bits of evidence from varied library sources. For this reason historical geography faces a most difficult task and demands unusual acumen and integrity of its disciples.

To the survey method accordingly is assigned the principal task in the development of geographic knowledge, provided that it develops clearness of purpose, precision of observation, and restricts itself to

[3] Brunhes and Vallaux, La geographie de l'histoire, pp. 50-57.

intensive work. There must be obviously some agreement as to the things to be taken into consideration. It would be an interesting and disturbing experiment for several geographers to study the same area independently. Aside from the inevitable difference in quality of the work, there would likely be serious discrepancies because of lack of agreement as to the things chosen for observation, because of divergence in manner of observation, and finally because of differences in interpretation. Can we speak of scientific results until we have some measure of common discipline by which our work is unified? Have we not given excessive freedom to temperament, to subjective impression, and in so far have been anti-scientific? Brunhes and Vallaux speak of adverse judgments of observers "par ce que leur propre mauvaise humeur ou leur maladresse leur ont cree de veritable ennuis."[4] The felicitous phrase suffers by translation. The geographer is in no danger of giving up his individuality as an observer by working towards a common definition of regional studies in terms of limits and critical elements. The present paper can attempt to recognize only a few rather generally accepted considerations of symmetry as to content of regional studies.

Content of Field Studies: *The Natural Region.*—In its simplest terms a geographic field study has the dual objective of representing the natural or original condition of the area and of showing the manner and degree of its utilization and modification by the people who live there. The first objective exists only in order to attain the second, under the postulated definition of geography. The manner of studying the natural region is therefore determined by the purpose for which it is to be analyzed, namely as a setting for the facts of human occupation.[5] Other expressions for the same idea as the term "natural region" are physical or natural environment, equipment, and resources, and the common French term "milieu."

Involved in such a study is (1) the selection of those elements that are significant to man, (2) their generic ordering as to type, as kinds of land form, types of soil or types of climate, (3) the areal distribution of the generic form, and (4) the associative distribution, as the relation of soil type and land form. Such a physical classification of an area is physical geography rather than physiography. On

[4] *Ibid.*, p. 51.

[5] Vidal de la Blache, Principles de Geographie humaine, p. 4: "Human geography therefore does not stand in contrast to a geography from which the human element is excluded; the latter has not existed except in the minds of a few exclusive specialists."

the one hand the geomorphologic studies, numerously carried out in Europe, especially in the classic field of the Alps, are essentially geologic. The more truly physiographic studies of Oberflaechengestaltung and of the explanatory description of land forms, as represented by W. M. Davis, are in an intermediate position. Geography encounters here an unsettled boundary line with geology. The land form is of course only a fragment of regional physical geography. Its genetic study is based on geologic processes and the greater the emphasis placed on its genesis the more nearly does the study become purely a phase of geology. On the other hand land forms and soil types, the latter commonly classified ordinarily in a genetic sense, presuppose a limited amount of physiographic explanation.

The content of the natural region has been best identified by the work of French geographers.[6] We have here also the Landschaftskunde of Partsch, Passarge, and others, and the concept of the Naturlandschaft as held by Gustav Braun.[7] These studies approach very nearly to the ideal of regional physical geography. There is still likely to be excessive emphasis in these European models on the land form and its morphology and a consequent lack of symmetry in the presentation of the natural equipment of the area. It is only in exceptional circumstances that the area is physically dominated by land form alone. Locally, soil character, presence of great mineral resources, a climatic type, or a distinctive condition of vegetation, possibly of complex origin, may outweigh the significance of topographic form, or will at the least modify its significance. The biosphere involves the surface of the land and its contiguous "spheres" of air, water, and earth. In terms of human geography it also includes the covering of vegetation and, to a varying extent, its animal life. In a sense, approaching in breadth the definition of the economist, the land is all of these things. In this sense, not the land form but the land, as expressed in the associative complex of its elements, determines the natural region.

Recognition of characteristics, not the tracing of boundaries, is the urgent matter in the study of the natural region. For the present it is rather immaterial whether a field of study is coextensive with a natural region, is a fragment thereof, or cuts across natural boundaries. It is not even very important to determine now what orders and kinds of boundaries there shall be, or what names regions shall

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[6] See especially the summary study by Fevre and Hauser: Regions et pays de France, Paris, (F. Alcan, 1909), and de Martonne: Regions geographiques de France.

[7] Deutschland, Berlin (Borntraeger, 1916).

bear. Regional discussions have tended to lose themselves in the peripheries of regions, and the central theme of the content of the natural region remains neglected. As long as we imagine that physiographic description is an adequate expression of the milieu, and leap nimbly from "physiographic province" to "economic response" and "natural political unity," we are subject to acrobatic hazards.

Although the locational element is inherent and fundamental in the very notion of area, it probably has no place in the general concept of the natural region, except as special cases may demand such inclusion. Locational values are abstractions of distance, in which there is necessarily the relation of a certain distance or sets of distances to a life group. They come into play, they exist, only in terms of the process of occupation, and perhaps cannot be represented even apart therefrom. In its development, an area, undifferentiated from other sections on a physical basis, may become strongly differentiated by superior or inferior location. An industrial and commercial region may form by the gravitation into a centrally located district of lines of communication. Such is the case with that portion of the interior plains of our country that extends eastward from Chicago through southern Michigan and northern Ohio, a region whose advantages are essentially those of superior position. This area may be said to have become a strongly individualized geographic region in the process of its utilization, but not to be an originally distinct natural region.

Facts of Occupation.—The differentiation in use of an area is based on (1) the physical quality of the area, the nature of which has been discussed in the preceding section, (2) the character of the people as affecting the occupation of the land, (3) the time during which human activities have been at work. These bases, physical character, racial stock, and historical moments, are evaluated by means of an adequate expression of the facts of human occupation. The geographic argument proceeds not from physical causes to human consequences but from the facts of the use of an area by man to the interpretation of use in terms of the three bases mentioned.

Thus Brunhes has declared to us the three essential facts of geography as productive, unproductive, and destructive occupation of the land.[8] He has also used the terms sterile, productive, and destructive occupation.[9] The most important contribution here is the insistence upon the manner of occupation as the primary objective of geographic study.

[8] Human Geography, edited by Bowman and Dodge.

[9] Brunhes and Vallaux, Geographie de l'histoire, p. 24.

Neither the term unproductive nor sterile is an adequate expression for the habitations of man and his use of land for manufacturing and commerce. The meaning is clear but a happier term is wanted. Braun sees as the goal of regional geography the explanation of the transformation of the natural region, or region in its original condition (*Naturlandschaft*) into the area as modified by man (*Kulturlandschaft*).[10] Perhaps no better definition of geography has been given us than this idea of the derivation of the cultural area from the natural area. Passarge similarly distinguishes between the physical Landschaftskunde and the social Landeskunde, setting up for the latter three theses to be investigated: "(1) How has the area affected man; in what respects has it limited him and in which ones left him a free agent? (2) What different aptitudes for progress have the several racial stocks? (3) How has man modified the area by development and exploitation?"[11] The essential unity of these definitions is evident.

We may study the occupation of an area by a group in the light of the following distributional contrasts: (1) Densities of population, (2) distribution of forms of settlement, (3) distribution of racial stocks, (4) distribution of forms of occupation, or economic systems, (5) areal classification of type of use of land, (6) productivity of the land per unit area and per capita, with special reference to production in excess of local needs, (7) areal and per capita accumulation of wealth. This material will furnish the coherent and cogent story of the character and success of the activities of the people in the interpretation of these areal human data. The emphasis throughout it will be noted, is on the conditions of occupation, not at all on "geographic influences." The facts, once established, their interpretation is in order, without either priority or disregard of physical factors. A negation, a partial negation of potency of physical environment, therefore, ceases to be a disturbing result in geographic study. The lack of correspondence of the facts of human occupation and of physiographic boundaries is possibly more intriguing than the establishment of such correspondence, because it carries the problem into the more intricate realm of human will and historical association. Why should not all areally operative factors leading to the success or failure, growth or decadence, of a people, be of equal significance to the geographer?

Back of these facts of occupation is the dominant purpose of measuring the amount of change that man has brought about in the natural area by his presence. Such a study is not alone a study of the oppor-

[10] *Op. cit.*

[11] Mitteilungen d. geog. Gesellschaft in Hamburg, 1919, p. 39.

tunities and handicaps man has encountered in the area, but also an inquiry into the quality of his stewardship over his natural inheritances. The actual content of the inquiry is therefore less simple than the mere contrasting of original and present condition. Intermediate inquiries need to be carried out, as for available census periods, showing the trend of modification. Such trends, as of density of population, type of production, land used and unused, if properly worked out, enable a projection of the experience of human occupation into the future, and provide a measure of stability and of change, that give us a reasonable expectation of greater future significance of the area or of its decreasing desirability.

SURVEY METHODS; *Field Mapping.**—The stated objectives of regional study suggest an appropriate technique of field work. The sprightly sketchiness of observation of the geographer-traveler may retain its use in explorations and other forms of preliminary reconnaissances but intensive work needs to rely primarily on rigorous observation of unit areas in previously determined details. Notes are to be taken not simply when some happy illustration impinges upon the consciousness of the observer but notes are to be put down so systematically that they form a definite set of quantitative data as to content and areal interval. The most formal sort of geographic notes is to be found in the mapping of data, and a development of methods of field mapping is the obvious solution of the problem of quantitative areal study. Following the statement of the purpose of regional study, the field work may then center upon two types of mapping, the first one intended to show the original resources or character of the area, the second to embrace the areal expression of its present condition of occupation.

The physical geography of the area involves the representation on the map of the following items: (1) Land form. Classification of land form according to origin is perhaps not necessary, but is so generally desirable from the standpoint of clearness that the burden of proof rests rather on those who reject this method than on those who follow it. A distinction of a landscape according to types of moraine and outwash features conveys such definite concepts and allows such an economy of description that its use is almost a matter of course. A map classification will therefore ordinarily attempt to distinguish

* This paper does not undertake a discussion of field cartography, such as traverse methods and sketch-mapping, as applied to geographic studies. The author believes that the field student should know how to make a reasonably accurate base in the field and to sketch in perspective.

all land forms differing in their origin, and will show them of course in areal extent and relation. There needs to be also specific recognition of the significance of the land form, or the nature of its slopes. Especially should prevailingly steep slopes, whether long or short, be distinguished in mapping, most particularly where such slopes are limiting or differentiating factors in the use of the land. Observation may indicate an angle of slope that is critical in the use of the land. Insufficiently drained surfaces are distinguished similarly as to extent. The geographic purpose here is the classification of topography in terms of use potentiality, as of contrasts in depth, organic content, fication of soils is most valuable, supplemented by classification in terms of use potentially, as of contrasts in depth, organic content, physical and chemical character. (3) Characterization of water bodies and their margins. Streams may be differentiated not only as to size, but as to gradient and variability of flow. Lakes differ in significance according to their nature of bottoms and shores, to cite only two simple use factors. (4) Mineral resources differentiated as to kind and importance. (5) Natural lines of communication as related to physical barriers and corridors. (6) Local differentiations of climate, especially as affected by altitude, exposure, and air drainage. (7) A closely related task is the reconstruction of the original vegetative covering. From it alone is it possible to measure fully man's modification of the area by his occupation. This commonly can be in part only a field task. In the states of the General Land Survey, the beginning of such a study is found in the General Land Office plats and field notes.

The sum of such an inventory is the delineation of the area in its natural condition, or of the environment in which man has set his energies to work. This natural region is infinitely complex in its physical manifestations, and the preceding outline has therefore attempted to stress the geographic viewpoint, namely, the selection of those features that are or may be significant to man as making his livelihood in this area. This point is most important, for upon it depends the selection of the material to be represented.

It may be objected that the observations proposed are the appropriate task of several specialists in distinct fields, physiography, ecology, soils, and so on. It facilitates studies in human geography to be sure where the other workers have gone before, but how often is this the case? If our regional geography is not to remain disorganized and incomplete for a long time, the student of regional geography must school himself in these fundamental observations. His participation in such observations is however due to something more than the desire to fill in blanks in the knowledge of physical condi-

tions. His aim is the unified viewpoint of the effectiveness of the physical environment as a whole, and this view is not shared by any of the workers in cognate fields, nor is it attained by the sum of their observations. He differs from them in selecting those items that represent the background and the medium of human activities, as it were, the human habitat. The ecologist may be interested in plant associations and migrations that have little bearing on the human value of the area. The geographer is interested in the kind of vegetation that man has had to subdue and from which he has drawn support in becoming the master of the region. Even with the full collaboration of the related specialists there remains for the geographer the task of correlating and reclassifying their results for his ends. Finally, the geographer has the graphic problem of combining the several types of observations into one map and one account that sets forth for the natural region the areal contrasts of environment.

The second field task is to represent by maps the nature of the occupation of the area by man, so that the amount and manner of modification of the region through man may be deduced from this and the preceding map. The area is here considered as oikoumene, and the map may be designated in its broadest sense a cultural map. The task of the geographer differs from that of the topographer in the effort to generalize the whole of the area into cultural forms instead of representing only the simpler cultural features of domicile and line of communication. Three principal themes suggest themselves, the distribution and classification of buildings, of lines of communication, and of uses of the land for primary production.

(1) Field work is excellently suited to precise population studies. Intensive mapping should include the representation in rural areas of individual homes and other structures of major importance. In this way we can ascertain (1) spacing and (2) choice of location of habitation, (3) type of architecture where it is an index of prosperity, occupation, or racial origin, (4) condition (occupied, vacated, abandoned, ruin; improvements maintained or deteriorated), (5) ownership, (6) color, race, and nativity of occupant. In this manner a very fair record of the progress or decline of an area may be secured from the analysis of habitational data alone. An urban illustration of most elaborate character is given by Booth's studies of the condition of the population of the city of London, which involved the mapping of all squares, rows, and closes in terms of character and wealth.[12] Habitations may be classified further according to the nature of livelihood of the occu-

[12] Booth, Charles, London—Life and Labor.

pants. The individual habitation in rural districts or the square in cities provides a convenient unit for plotting many kinds of population data in field work, subject to great freedom of choice on the part of the field student. Precise, quantitative data of true geographic importance can be secured in this manner and at a very rapid rate. It is thus possible to secure proven and valuable material where time does not allow the complete mapping of land utilization, and the method is successful also where an elaborate base map is not available.

(2) The problem of communication is worthy of further attention in field mapping. In the Ozarks, for example, there are all-weather, wet weather and dry weather roads. In ordinary weather, the farmer may haul out over a creek-bottom road. During the rainy season he forsakes this road for one that winds along the ridges. There are roads, the hauling capacity of which is limited by a hilly or sandy stretch or by a series of fords. Such limiting values of roads are worthy of representation. Possibly they can be expressed in terms of usual loads carried over them. In the same area are streams unsuited to ordinary navigation which are employed to raft out timber in seasons of freshets. Telephone lines and even mail routes may differentiate rural communities socially. Railroad lines may be classified according to differences in their service. A communication map that serves as a measure of the contacts of a community with the outside world represents a type of study that will long remain far from being a routine performance.

(3) The major task in intensive field work probably is to represent the manner in which a given land area is utilized.[13] A broad classification of land utilization has not been made in terms of field studies as yet. The census studies of O. E. Baker represent however a most valuable approach to the problem in the field.[14] It may be said in general that the field work will attempt to show the entire land area as distributed among different forms of primary production (or non-production), and will attempt to show also increasing or decreasing productivity. The result is a map in which all land is classified in these terms. Some experimental studies in Michigan indicate for that state the following use classes: (1) Farm area. This is defined as land under management by farmers and accordingly the limits of the

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[13] See the author's paper: Mapping the Utilization of the Land, *Geog. Rev.*, vol. 8, pp. 47-54.

[14] See especially: Land Utilization in the United States, *Geog. Rev.*, vol. 13, pp. 1-26 and Increasing Importance of Physical Conditions in Determining Utilization of Land in ANNALS ASSN. AMER. GEOG., vol. 11, pp. 17-46.

individual farm holdings are shown, and the farm holdings are distinguished by symbol from holdings of other types. The farm area is subdivided into plow land (land that is regularly under tillage) orchard area, permanent pasture, permanent meadow, wood lot, and other unimproved and unclassified land. The most troublesome thing here in field determination is the tilled land. What is meant is the land which the farmer usually calls his "fields," his cleared ground suitable for cultivation. The inexperienced observer is likely to be misled by fields that are in grass or lying fallow. A field in hay and a meadow are of course two different things and usually the farmer distinguishes correctly between them. Where fields are not fully established, as in the "deadenings" of the south and in stump lands, the incompleteness of clearing should be noted. It is desirable further to classify farms according to farming system, as general, grain, dairy, fruit or other type of farm. Occasionally an individual farm may be mapped separately to show the actual farm practice in the use of the land in a particular year, but otherwise the crops grown on particular fields are not shown. (2) Forest land (not in wood lots). The general classification is: virgin forest, merchantable second-growth, non-merchantable second-growth. Land that has been cut over but on which a young growth is reestablishing itself that will make valuable timber in time belongs to this class. Cut-over land on which neither seedling nor sprout growth of commercial varieties is in process of reoccupying the land belongs into the next class (3). The distinction between restocking and non-restocking cut-over land is economically most important. The term forest land is therefore here employed not in the sense of a previous or potential condition, but in that of its actual present situation. Since the purpose of this phase of the mapping is to show the condition of the forest land, the forest association, as coniferous or hardwood, is not shown in this connection. It has been provided for above under the study of natural vegetation. It may be necessary to depart from this practice if the character of the forest species have been seriously changed from the original condition by cutting or fire. (3) Idle land. This is land that is not under an economic system, from which no definitely recognized returns in money or other forms of satisfaction are being secured. Here belong the devastated and non-restocking cut-over lands, abandoned farms, barrens of rock, sand, and swamp, and other land residuum. (4) Industrial properties, as mining lands, quarries, factory sites, and (5) residentially occupied areas, not farm-steads, such as suburban districts and resort areas. The classification is concerned with extra-urban areas only and has been

modelled on conditions in Michigan. Different areas will suggest many variations.

Thus far we have considered simply differences in the character of production from the land, and have differentiated producing and non-producing areas. The same maps may be made to show the destructive effects of human occupation. In the Lake states in particular lumbering has been followed by repeated fires which may have burned out the precious humus on sandy uplands to such an extent that the land is ruined for a long time to come. Swamp fires in some cases also do serious damage to land. Farming on rolling lands by clean cultivation has resulted in many places in slope wash and gullying with varyingly serious effects. Overgrazing of certain pasture or range lands may result in a deterioration of land that is difficult to make good. The map can show the character, extent and location of such destruction. We are then no longer dealing with the impressions and discontinuous observations of the note book but with a complete quantitative statement. We are measuring the results at which man has arrived in the use of his area and know what his outlook for the future is in that area.

Taking Notes.—The close and continuous scrutiny of a specifically limited area that is enforced by such a plan of mapping enables the systematic taking of notes by section or other unit subdivision of the area. Observations that do not belong on the map find room in the notes and some of these observations may be made at definite intervals, as for each farm or each parcel of land. The agricultural economist and sociologist in particular have perfected the use of tally sheet or questionnaire to this end. Thus the note book may contain areally keyed data on farm practices, outside sources of income, changes in cultivated acreage in individual crops, crop yields, surplus marketed, rate of removal of timber, local movement of population, length of residence of inhabitants, and so forth. It is easy to overload in such matters of comprehensive field statistics. At the beginning of the field work it is therefore important to decide on a minimum schedule of questions that will supplement the map record of the particular area in a few important particulars. Such questions commonly will center upon the standard of living and the movement of population. This census method does not imply dispensing with the more informal notes that record other observations and raise field hypotheses.

Intensive field work naturally suggests the consultation of various local statistical archives. The court house offices in particular are likely to be sources of valuable knowledge of local conditions. The

assessor's books show distributions of wealth and size of land holdings, and can be used as a basis for the classification of type of land ownership. Tax records, if checked back through a period of years, show trends in distribution of wealth, size of holdings and form of ownership. Here again it is easy to launch forth on too ambitious and too obscure a plan, but the material is available for valuable analysis.

The purpose of these suggestions is not to make field work mechanical, but to increase its precision. The choice of things to be observed must remain a matter of individual judgment as to the significant relationships between area and population. Out of such field measurements will come the realization of Brunhes' ideal of statistical coefficients. From them the geographer will determine ultimately the extent to which the theory of mathematical correlation is to be introduced into geography.

Selection of Areas.—Except by a publicly financed survey, studies of this nature cannot be made for large areas. In Michigan such a survey was begun in 1922, called the Economic Land Survey, and was carried out for an entire county. In this case the special fields such as soils, forestry, and agriculture, were worked by specialists, but it is worthy of note that the geographic viewpoint set forth above served as the standard in determining what should be included and as the cementing force that bound the various studies into a unified whole. It is altogether likely that official surveys will develop that will attempt to evaluate the economic situation and possibilities of areas as a whole instead of single elements thereof. An area after all is a physical complex become more complex by occupation, for which only the comprehensive unity of a geographic survey can supply a satisfactory evaluation.

It is not proposed that the method outlined can be carried out generally for the whole of regional geographic studies. Expense, time, and mass of material accumulated alike make this prohibitive. As a fundamental device in regional field work it is applicable however in the following forms: (1) by the complete intensive working of small areas of strong geographic individuality and high interest, and (2) by the selection of restricted areas scattered through a larger region, in which case the general area is worked extensively, and type locations are selected for such intensive study. The future may show that doctor's dissertations can be worked up in as small an area as a township, if this area represents an important type not previously studied. The test of course lies in the significant novelty of the technique employed as well as in the bearing of the generalizations

developed. Perhaps a township, or a county, is a better field for testing research ability in geography than a state or a great region.

In the study of larger areas the small localities for intensive work may be selected according to several methods. (1) A reconnaissance of the area and its existing maps may indicate limited tracts that serve as miniatures of important conditions. In this case the whole region may be analyzed in large part by the judicious selection of type localities. (2) The sampling method may be employed by the selection of sections or other units of nearly equal size distributed at similar intervals through a region. This results in the intensive study of a certain percentage of the total area, dependent on the spacing of units. (3) A narrow continuous strip of territory may be taken across the entire region, providing as it were an areal cross-section. This method would seem to be particularly applicable where the pattern of the region is in more or less parallel belts, and to lose in significance with increasing irregularity of areal contrasts. By any of these methods systematic, detailed, and correlated observations can be secured. Probably each of the methods has its points of superiority and it is hoped that their respective merits will be put to the test as a field technique is worked out.

The Familiar Scene.—The science of genetics was born in the garden of an Austrian monk; Hugh Miller discovered in the Old Red Sandstone of his native hills fundamentals that helped form the science of geology. All about us lies a great and essentially uncultivated field of geography. The strange and distant scene has born an unholy charm to the geographer who has thought that travel in far lands is the beginning of geographic research. The "grand tour" has long been recognized as part of the training of the man of culture. But what special competence have we to evaluate the geography of a country, whereof we understand but poorly the language and institutions, except as we have prepared ourselves carefully for comparative study by an immersion into the problems of familiar areas? Then only can we discover truly the significant contrasts of far countries. May not our failure to acknowledge the dignity of study in the superficially familiar scene be a partial explanation for the distressingly small production of research studies among American geographers?

This paper has been concerned with content and methods of field studies. It may close perhaps with an invitation to joint participation in American explorations. As a nation we are in a period of interesting and, in places, critical relationships to our land. In Michigan, to cite it as a single example, we have the rapid development of industrial centers, the critical situation of many counties that have depended on

lumber, the contrasted adjustments to their areas of rural settlements of different racial stocks, particularly Finnish, Polish and Dutch, the agricultural stability of certain districts and the declining prosperity of other farming counties, the emergence of a regional resort economy, the individuality of the iron and copper ranges, to mention only some of the untouched fields of geographic study. Every state has an untouched wealth of geographic material awaiting analysis and generalization. We have areas on which the last pioneering of the continent is now going on. In a few more years that record will become a field of the historian. Today it is the opportunity of the geographer.

One major theme of regional geography in particular invites attention. Areas appear to grow more and more unlike in the process of their use. To what extent is there an increasing differential inherent in regions? Some sections develop for a long period and pass rapidly through stages of development. Others reach an early development and thereafter become stagnant or enter a decline that continues indefinitely. From many districts of our young country the more ambitious elements of the population are withdrawing steadily. Poverty spots, pools of residual population are forming. Land is now passing out of economic use in this country more rapidly than new land is being occupied. Timber devastation, soil erosion, overgrazing, soil depletion, failure of irrigation, dry farming, and drainage, here and there causing a pitiless revaluation of areas. Land is becoming an increasingly restricted economic good; we should know as geographers what is happening to our land.

TITLES AND ABSTRACTS OF PAPERS

CINCINNATI, 1923

N. A. Bengston.

The Geography of Santa Elena Peninsula, Ecuador, S. A.

The Santa Elena Peninsula region of Ecuador is the area that extends westward approximately 140 kilometers from Guayaquil, ending in the promontory known as Punta Salinas. The topography consists of slightly dissected coastal flats, maturely eroded plains of moderate height and mountains rising to altitudes of 800 to 1000 feet, characterised by steep slopes. The region is located where the influence of topographic differences is very marked. These are especially effective in causing great differences in rainfall within small distances, in miles horizontally and in feet vertically. Thus the proximity of desert and jungle causes bold contrasts of industrial pursuits and in modes of living. The banana farmer and the goat herder are close neighbors. People live in villages where water holes have been found. Their houses are perched on poles with floors about 8 feet above ground, to get away from the dust, rolling sand and creeping life forms which prevail on the land surface of the desert. In the jungle, the same type of architecture serves to get away from the mud of the rainy season. Because of the sharp contrasts, the region can well serve as a model for the study of effective geographic influences.

Claude H. Birdseye.

Through the Grand Canyon of the Colorado River.

Description of recent Geological Survey exploration of Marble Canyon and Grand Canyon of Colorado River, Arizona, in which the uncharted portions of the river from Lees Ferry, Arizona, to the mouth of the Grand Wash were mapped in detail. Paper illustrated by lantern slides showing features of historic and scenic interest as well as views of the boats running some of the rapids.

Albert Perry Brigham.

Association of American Geographers, 1903-1923.—Read by Title.

History of Associations not proposed; comment on growth and results; Vice Presidential address of W. M. Davis before Section E. St. Louis, 1903; a society proposed, principles and policy then set forth; organization and first meeting; the constituent members, range and character of their work; dates and places of meeting, presidents; regional distribution of members, officers and meetings; publications by the Associations; origin of the National Council of Geography

Teachers; unofficial relations of Associations to Transcontinental Excursions of 1912; relations with American Geographical Society; spirit of social and corporate activity; results in publicity for geography; influence on Universities; progress in developing geography and bringing it into the educational and public consciousness of America.

Charles C. Colby.

A Geographical Analysis of the Apple Industry of the Annapolis Valley.

The apple industry has become the center of interest in the agriculture of the Annapolis Valley. In the present analysis the important aspects of the industry were analyzed to discover in what ways and to what extent they are related to the natural environment.

Although apples are grown on most farms in Maritime Canada, apple culture on a commercial basis largely is confined to the Annapolis Valley. Within the valley the orchards are irregularly distributed on the crests or slopes of the low hills which characterize the floor of the valley and along the lower slopes of the escarpments which flank it. An outstanding factor in the progress of the industry is the regularity with which the apple crop is produced. This is due to (1) the general suitability of the climate, (2)the presence and utilization of sites equipped with a proper combination of soil and drainage and with the slope necessary to offset, as far as possible, unusual weather conditions, and (3) the widespread use of orchard practices which aid productiveness.

Great Britain is the principal market for Nova Scotian apples, and the rise of the industry to its present position would not have occurred without the stimulation of that active market. During the harvest and packing season considerable labor in addition to that normally employed in the valley is required. This is supplied by men from Halifax and Lunenburg who are released in the autumn from the factories which center in those places. The fruit is consigned principally by cooperative growers' organizations, most of which are members of a central organization. The development of these organizations has been favored by the compactness of the fruit district, which is one hundred miles long and about six miles wide. The apples are shipped in lots of not more than 20,000 barrels, in cargo liners. This regular flow of relatively small shipments makes storage in the British ports unnecessary. That regular shipments of apples in small lots can be made is due to the geographic position of the port of Halifax, through which most of the fruit is shipped. This port faces the North Atlantic

trade route in such a way that it is practicable for ships from all the Atlantic ports in the range from St. John to Norfolk to be routed via Halifax if cargo is available. Consequently, weekly sailings from Halifax are maintained through the autumn and winter when the fruit is moving. This and certain other minor factors have given Halifax in most years a lower ocean rate on apples than is enjoyed by other ports. Because of the seaboard position of the Annapolis Valley it has a shorter and cheaper rail haul to the point of shipment than has Ontario, Western New York, or other American apple districts.

M. L. Fernald.

The Flora of the Unglaciated Region of Northeastern America. The region of islands and peninsulas centering on the Gulf of St. Lawrence is characterized by a large element in the flora, which has little or no close relationship to the plants of the surrounding continental area. This peculiarlity is especially striking on the tablelands of the Shickshock Mountains of the Gaspé Peninsula and of the Long Range of western Newfoundland, where a majority of the plants are identical with or closely related to typical Cordilleran species of western America, some of them even with Andean and Fuegian species. At lower levels, and especially on the sea-coasts of the Gaspé Peninsula, the Magdalen Islands and western Newfoundland many of the plants are closest related to characteristic coastal species of the Pacific (from California or Washington to the Aleutian Islands, Kamtchatka or northern Japan). Mingled with this western flora are the ordinary plants of the mountains of northern New England and Arctic eastern America, species which were forced south from the Arctic by Pleistocene cold; but the Cordilleran and Pacific coast types are not found in New England and in Arctic eastern America; they are restricted to the region centering on the Gulf of St. Lawrence and they are plants of every conceivable habitat in the west.

Study of all the factors eliminates the possibility of their being recent immigrants from the west, and their occurrence on the Magdalen Islands is at once correlated with the well-known unglaciated condition of these islands. Recently Dr. A. P. Coleman has demonstrated the unglaciated condition of theShickshock Mountains and during the past summer, following the clue furnished by the peculiar relationship of the plants of the Long Range of Newfoundland, he has studied that region and reports that there was no general glaciation there above altitudes of a few hundred feet. This western flora isolated about the Gulf of St. Lawrence, is, then, a relic of the ancient flora which outlined the

Pleistocene glaciation in this region but which was exterminated in the heavily glaciated area between the Gulf of St. Lawrence and the Rocky Mountains.

Alice Foster (Introduced).

A Geographical Interpretation of the Cotton Manufacturing Industry in Orizaba, Mexico.

Cotton manufacturing in Orizaba is of the large-scale type. In quantity and quality, the output is of significance even when considered apart from the location of the mills in non-industrial Mexico. In its present form the industry is the culmination of a series of adjustments to environment, having its origin in the primitive cotton-growing and cotton-weaving industries of the pre-Spanish inhabitants of the district. For modern manufacturing the district offers the attractions of abundant power and cheap labor.

The water power of the district is estimated at 100,000 horse power. It is furnished by the Rio Blanco and its tributaries, which drain an area with a surface slope averaging 100 feet to the mile for 70 miles. The gradient is interrupted at Orizaba by the outcrop of resistant strata dipping upstream at high angles. Within five miles the Rio Blanco falls 1,300 feet. The annual rainfall of more than 100 inches has a marked seasonal distribution, but frequent gentle, long-continued winter rains, drainage from the perennial snow fields of Mount Orizaba, the presence of a forest cover on the steep slopes, and the prevalence of solution channels in the limestone hills exert an equalizing influence on river regime. As a result of these conditions, there is only a short season of low water during the months of the northern spring.

The labor supply which attracted the modern mills was furnished by the comparatively dense population of the valleys converging at Orizaba. This population density had been attained through the utilization of the rich agricultural resources of the district and the commercial advantages of its location upon an important Mexican trade route. The resident social group had reached a comparatively high stage of economic development and had been trained for many generations in the fundamental processes involved in textile manufacture. A low wage scale is possible because the mild winter precludes the necessity for artificially heated houses and heavy clothing, because the wants of the laboring people are supplied chiefly through local production, and because the modern mills were established at a time when the population density was approaching the saturation point under existing conditions.

J. Paul Goode.

I. The Evil Mercator.

II. The Homolosine Projection: A Contribution toward the better portrayal of the whole earth's surface.

I. Mercator's projection was devised as an aid to navigation. For this purpose it has no superior. It was never intended as a world map for distribution, and other geographic uses. Its shortcomings are here shown, and suggestions are made for better projections for use by geographers and others.

II. A new projection is presented which offers very marked advantages over all previous projections for use in the portrayal of the earth's surface entire. It is strictly an equal area projection; it gives exceptionally good shapes to the continents; it has parallels as straight lines, facilitating studies in comparative latitudes; a scale of miles can be used in latitudes up to 40; it is adapted to presentation of either continents, or oceans, like the interrupted homolographic, but is superior to that projection in preserving more nearly the true form of area shown.

Herbert E. Gregory.

Low Islands and High Islands in the Pacific.—Read by Title.

Low islands are largely of coral reef origin; high islands are volcanic or ancient land masses in various stages of dissection. The two types of islands are contrasted by soil, water supply, fauna and fiflora, and in consequence the history of their native inhabitants differ. The Pacific islands offer an excellent opportunity for the investigation of the influence of physical environment.

George F. Howe (Introduced by C. F. Brooks).

The Summer and Winter Weather of Selected Cities of North America.

For purposes of giving a clear picture of the climate of a place a statement of the frequencies with which well known weather types occur is essential.

Many studies have been made of the factors in weather which vary, such as rainfall, humidity, temperature and others, but it is not each factor varying by itself which makes up our weather in most cases, but the several factors in their daily combinations.

Thirteen types of weather were chosen and for the five year period 1917-1921 the percentage frequencies of each were found for various cities in North America. The thirteen types are derived from the

important combinations of four classes of temperature, two of precipitation and two of wind; hot and rainy; hot, fair and windy; hot, fair and quiet; moderate and rainy; moderate, fair and windy; moderate, fair, quiet; cool and rainy; cool, fair and windy; cool, fair and quiet; cold and snowy; cold, fair and windy; cold, fair and quiet; cold, windy and snowy.

Maps of the various types have been made. They show quantitatively what we have long known qualitatively from the usual standard maps of special phases of single elements.

Percentages of weather types may be used in teaching. Instead of impressing on the pupil that a certain place has a certain mean summer temperature he may be told that this place has a climate made up of various percentages of weather types, many of which he has probably experienced at home.

Thus he is learning about the weather as it occurs and not the climate as the agglomeration of single factors. Doctors sometimes have occasion to send patients to places with a certain kind of climate, but have no definite information as to where that place may be. An insurance company fortified by a map of type percentages is able to set rates better than a company which "takes a chance."

It is hoped that these maps and tables of weather types supplementing others may give us a better idea of our climate and be of use along other lines.

Ellsworth Huntington.

Presidential Address, Geography and Natural Selection. Printed in Full, ANNALS, March Number, 1924.

Preston E. James (Introduced).

Development of Transportation in South America.

The development of transportation was shown by a series of five lantern slides as follows: Transportation in 1500, at the height of the Inca Empire, showing the Inca Roads at their maximum development; transportation in 1820, at the close of the Colonial Period, showing the chief Spanish trails and river routes; transportation in 1880, after the early railroads had been started, but just before the great decade of Railroad building in Argentina; transportation in 1910, just before the World War; and transportation in 1923, showing the present conditions. The maps show that certain lines of communication were determined in Inca times and were later followed almost exactly by Spanish Colonial trails and now in places by railroads. The early

importance of the Andean mining centers, such as Potosi is illustrated by the convergence of the early trails on these points, supplying the mining population with food, clothing, and pack animals from more favored localities. The very intense development of transportation in Argentina and in parts of Brazil is a distinguishing feature of the more recent maps. The economic pre-eminence of the Argentine Pampa is reflected in the relatively dense railroad net centering on the Pampa ports.

Mark Jefferson.

The Passing of the Waterways.

Before railways were developed in progressive countries, rivers and canals were of the utmost importance. Nowadays they have become of very slight significance, chiefly because of the utterly inadequate terminal facilities, smallness of the carriers and uncertainty of schedule added to the utter failure for the winter in most countries.

The Rainfall Map of South America.

Deals with the human importance of distribution of rainfall in the continent, the present state of our knowledge and some important problems to be solved.

The Size and Shape of Sheets of An Atlas of the United States.

Points to some sheets already existing on various scales and shapes and suggests a plan for a uniform scale and harmonic shape of frame-line to allow ready reduction to half and quarter scale without waste of margins.

Clarence F. Jones (Introduced).

Transportation Adjustments in the Railway Entrances and Terminal Facilities at Montreal.

Although Montreal is both a great port and an important railway center, there are only six railway entrances to the island on which the city is located. In order to understand why the entrances are limited to this number, it is necessary to realize that Montreal stands on the largest island of a group located at the confluence of the Ottawa river and the St. Lawrence, where these two rivers break up into a number of streams and lakes surrounding the island of Montreal. Each of the six entrances is located at a point which afforded a feasible crossing to the principal island. There are few, if any, other points at which a railroad could be built to the main island without meeting engineering difficulties so serious that the expense of construction would be economically impossible under present-day conditions. These six places

are (1)St. Lambert, (2) Lachine, (3)Vaudreuil, (4) St. Eustache, (5) Bordeaux, and (6) Charlemagne. At the bridges marking these points all the railway lines which enter Montreal focus. The railways entering the Island of Montreal have had to build a total of eighteen bridges in crossing the wide St. Lawrence and the channels of the Ottawa. The two bridges over the St. Lawrence are enormous structures and rank among the largest railway bridges in the world. The long detour necessitated by the location of feasible crossings and the bridges constructed there represent significant transportation adjustments to natural conditions by the railways in reaching the great port of Canada.

On the Island of Montreal other adjustments have been made by the railways in gaining entrance to the heart of the city and in making connections with the waterfront. The Grand Trunk and the Canadian Pacific from the southeast enter along definite routes marked out in a large measure by natural features. The former follows the bed of a former lake and the course of the St. Pierre River, while the latter enters along the upper edge of a distinct cliff, from 90 to 100 feet above the level of the Grand Trunk. The roads entering from the northwest found an obstacle in their way in the Mount Royal Ridge. One made a long detour around the north end of the mountain and the other came in through a tunnel under Mount Royal.

The railways entering Montreal have seven assembly yards all of which show adjustments to natural conditions. Available low, wet or stony land along the railway lines outside of Montreal and the restricted area in the city between the St. Lawrence and Mount Royal have operated in locating most of the railway yards a considerable distance from the waterfront.

Three belt lines connect the railways entering the city. Two of them are outer routes which make a wide detour around the Mount Royal Ridge in order to connect the railways which enter from the southwest, west and north. The third, the Harbor Commissioner's railway, serves as an inner belt line. It hugs the bank of the St. Lawrence and in some places stands on made land.

Wellington D. Jones

Field Mapping in Economic Geography.

Map showing the utilization of the land and the natural conditions which have a bearing on such utilization are indispensable in thoroughgoing studies in regional geography.

In the field attention should be directed first to the mapping of the utilization of the land, and subsequently to the mapping of those

natural conditions which are discovered to have a bearing on land utilization. Experimentation by geographers in areas of various types is needed in order that something like common agreement can be reached as to the best methods to use in making these maps which are so essential in studying the relation between man's economic activities and natural environment.

G. R. Mansfield.

Tertiary Plantation in Idaho.

Field work by members of the U. S. Geological Survey and others has led to the recognition of an ancient erosion surface or peneplain in parts of Idaho, Montana, and Wyoming. Differences of opinion have arisen regarding the age and character of this peneplain. The problem is regional in character, necessitating more extended field work before a final solution may be reached.

The paper gives a discussion of the problem in the light of studies by the author in southeastern Idaho. It is concluded that the idea of post-middle Miocene planation across earlier Tertiary and older rocks, as advocated for Idaho by Blackwelder and Rich, is not proved by the available evidence. There seems a probability that the erosional history of western and northern Idaho and of western Montana was somewhat different from that of southeastern Idaho or of western Wyoming. For southeastern Idaho the evidence seems to favor pre-middle Miocene planation succeeded by: (1) middle Miocene deformation; (2) late Miocene and perhaps early Pliocene erosion; (3) Pliocene deformation, erosion, and deposition; and (4) early Pleistocene deformation or rejuvenation and subsequent erosion.

Geography of Southeastern Idaho.

The paper presents a brief regional geographic study of southeastern Idaho. The country lies mostly in the Northern Rocky Mountain province but includes parts of adjacent physiographic provinces. The mountains reach a maximum elevation of nearly 10,000 feet and rise 3,000 to 4,000 feet above the broad intermontane valleys.

The physiographic development, which is complex, is briefly summarized and the erosion stages indicated. The climate is semi-arid and the vegetation responds actively to it. Animal life, which was formerly abundant, is now restricted to small game that is rapidly diminishing in numbers. Aside from timber and agricultural possibilities the region has great natural resources of phosphate rock with other minor resources.

The region was frequented in the early days by fur traders and trappers and was on one of the favorite emigrant routes to the west, the Oregon trail. The early history and settlement of the country are, therefore, briefly sketched. The Oregon Short Line, which serves as the outlet of this country, now follows in part this route. Much of the region, however, is relatively remote from the railroad but has generally passable roads. Agriculture and grazing are the chief industries at present, but there are some phosphate mines and this industry is destined to assume large proportions in the future.

The work of man has transformed sage covered slopes and dreary wastes into attractive and picturesque rural communities. By the construction of ditches and reservoirs he is modifying the conditions of water circulation, both surface and ground water. These changes may have an important influence upon the future physiographic activities of the region.

Lawrence Martin.

The Boundaries of the Continents.—Read by Title.

No geographer can give an accurate statement today of the area and population of any of the continents except Australia. Antarctica is easy as to population but its area waits upon further exploration. The difficulty as to the American continents arises from the absence of any conclusion as to whether the Republic of Panama belongs to Central America or to South America. We have always tacitly taken the Suez Canal as the boundary between Africa and Asia, but now that Egypt has been admitted to the family of independent nations one wonders whether to regard it as lying partly in Asia and partly in Africa, or to shift the continental boundary to the frontier of Palestine. Transcaucasia was usually treated by geographers as a part of Russia in Europe, but since Soviet Russia has ceded the Kars District to Turkey this part of the boundary between Europe and Asia comes into question. The same problem arises again as a result of the creation in Asia, by the Bolshevik authorities, of the so-called Autonomous Republic of the Kirgiz whose northwestern boundary transgresses the old boundary of Russia in Europe, north of the Caspian Sea.

A. E. Parkins.

The Growth in Southern Cotton Manufactures.

From 1870 to 1923 the growth of the number of active spindles in the cotton mills of the south was from 328,000 to more than 16,000,000. In the United States the increase during the same period was from 7 million to 32 million, and in New England from 5.5 million to about

16 million. The south now has about 50% of the active spindles of the country and 43% of the looms.

The probable causes for the southward migration of cotton manufacturers are:

1. Nearness to raw material.
2. Cheap power—Coal and electricity.
3. Cheap, yet intelligent, efficient, contented labor and English speaking American labor.
4. Low taxes and low cost sites.
5. Little adverse legislation. The public and the railroads have a friendly attitude toward manufacturers of cottons.
6. Freedom from labor difficulties.

The south is producing excellent goods at a cost 14 to 16% lower than New England mills.

Helen M. Strong (Introduced).

The Geography of the Trade of the United States in Agricultural Products.

Agricultural products are the most valuable group of commodities in the export trade from the United Staes. They comprise approximately 50 per cent of the value of all domestic exports. Of the value of all agricultural exports, about 80 per cent go to Europe as a whole, while the five manufacturing countries of the northwest Europe alone take nearly 70 per cent of all agricultural exports from the United States, which is nearly 80 per cent of all those to Europe. The United Kingdom is by far the chief market for agricultural products from the United States, taking nearly 40 per cent of the value of all agricultural exports; while Germany has been second in importance using about 20 per cent.

Cotton, meats, and grains are the chief groups of agricultural exports from the United States as to value. Cotton formerly comprised 54 per cent of all agricultural exports, but now equals only 32 per cent. Among meats, pork and pork products are by far the most important, while bread grains, notably wheat, form the major portion of grain exports.

Most of the agricultural products exported are produced in humid Eastern United States—east of the 100th meridian, where there are broad areas of relatively level fertile land.

J. Elmer Switzer (Introduced).

A Study of the Frequency of Weather Types of Certain Cities Within the Tropics.

To know the average seasonal rainfall, wind direction, and temperature of a region are insufficient to give an adequate conception of the actual weather conditions experienced by the inhabitants.

It is expedient that people of Middle Latitudes who go within the Tropics know with what constancy they may be called upon to endure certain types of weather, and to know how frequently they may expect respite from unfavorable weather conditions.

The types chosen for this study embrace those combinations of temperature, wind, moisture, and cloudiness which seem most effective in determining living conditions for the white man in the tropics.

The frequency of occurrence and the continuity of each type is noted for each of nine stations chosen, representing east and west coast conditions of the Canal Zone and of Mexico, the interior plateau area of Mexico, and the island location of Cuba. The variation in frequency and in character of types is related to the latitude and topographic locations.

It is to be hoped that this study will aid in giving a true concept of the climatic conditions in the southern part of our continent.

E. N. Transeau.

Plant Geography of Ohio.

The distribution of plants in Ohio as related to the underlying rock, the glacial and postglacial history of the region. The most notable effects of these factors are the hastening, or delaying of plant succession.

Eugene Van Cleef.

The Public Markets of Finland.—Read by Title.

The Public Markets of Finland constitute collective evidence of geographic influences upon the people. While much of the culture of Finland shows the result of contact with western Europe and America there still is apparent a very marked local influence. Finland is a geographical unit in many respects and yet the influences of its borderline position between occidental and oriental cultures are quite in evidence. The structure of the public markets which constitute an important activity in the daily movements of the people serves as an indicator of the impressions made upon the people by local and external factors.

Stephen S. Visher.

Estimating the Comparative Richness of a State; The Desirability and Difficulties of a Sound Estimate; Criteria.

The impossibility, with the present knowledge, of making an infallible estimate of the comparative richness of any state was pointed out. Four advantages are derived from a discussion of this type for the better known states. They are (1) Such discussions should form an excellent summary of the geography and thus be valuable to geographers. (2) The teaching of regional geography will be aided by such concise summaries and by the emphasis necessarily placed upon any important advantages and disadvantages that each region possesses. (3) A well-supported estimate of the comparative wealth of a state should greatly assist leaders in the state to plan more wisely their programs for the education of the citizens, for road-building, and for other governmental activities. For example, is Indiana unable to support as good a system of public schools as Wisconsin? (4) Private companies, especially railways and large industrial concerns, should be aided in their program of building by possession of a sound discussion of the comparative richness of the areas in which they operate.

The criteria to be considered are very numerous, including the areas' location in respect to several conditions, many phases of the climate, the soil, the topography, tillable land, mineral resources, water-power, and the people from several points of view, as well as the commonly emphasized items of area, population, and total assessed valuation. Many of the criteria are commonly considered in geographic discussions, but leaders in other lines often ignore important geographic influences. Even geographers have usually paid only slight attention to such important criteria as the comparative dependability of the rainfall, the significance of frequent changes of weather, storminess, light conditions, the proportion of the area which possesses soil, subsoil and topography favorable to tillage for thousands of years, instead of only for decades or centuries, and the proportion of the people who are capable, determined, progressive and energetic.

As an attempt has been made recently to estimate the comparative richness of Indiana, that state was used frequently as an illustration, in the oral presentation of the paper.

A. E. Waller.

Light as Factor in the Distribution of Flax.

Light has long been known as a geographic factor in plant distribution. The present deals with the effect of relative amounts of light

on the distinct phases, vegetative and reproductive, of several crop plants. Flax has been chosen in studying some of the features of this periodicity because where it is grown for its vegetative product, the fiber, there is a totally different climate from those regions in which it is grown for the oil which is stored in the seeds after reproduction.

Robert DeC. Ward.

A Cruise with the International Ice Patrol.

A brief statement regarding the establishment and work of the International Ice Patrol, supplemented by personal observations by the author made during the June, 1923, cruise of the U. S. Coast Guard Cutter "Tampa," on Ice Patrol Duty.

R. H. Whitbeck.

The Ohio River as a Waterway.